tients with infrequent but recurrent unexplained syncope. The insertable loop recorder (Medtronic-Reveal ILR) permits long term monitoring to establish the rhythm during syncope in this patient population.

Methods: Eighty-five patients (age 59 ± 18 yrs, 44 male) with recurrent unexplained syncope underwent implantation of the ILR. The ILR has 2 bipolar sensing electrodes 3.7 cm apart on the shell, measures 6.1 × 1.9 × 0.8 cm, weighs 17 grams, and is easily inserted in the left chest using local anaesthetic. Patients had a mean of 5.1 ± 5.5 syncopal episodes in the previous 12 months, and 70% of patients had symptoms for over 2 years.

Results: An acceptable R wave was obtained in all patients (mean 461 ± 279 mcv), with an average signal to noise ratio of 20:1, which was stable over 3 months. P waves were more likely to be seen when the device was oriented vertically (37%) than horizontally (14%). During a mean of 2.9 ± 0.9 months of follow-up, syncope, presyncope or dizziness recurred in 45 patients (53%). During 62 reported events in these 45 patients, bradycardia was recorded in 11 (13%), tachycardia in 14 (17%), multiple arrhythmias in 7 (8%) and sinus rhythm in 37 (45%). Patient-related failure to "freeze" the device after symptoms occurred 13 times (16%). A permanent pacemaker was implanted in 8 patients and 4 patients were started on pharmacologic therapy.

Conclusion: The ILR is a useful long term monitoring device in patients with infrequent but recurrent syncope.

4:30

868-3 Association of Postural Tachycardia With Supine Awake Bradycardia in Adults With History of Syncope: A Hemodynamic Evaluation

S.D. Satti, M.S. Nixon, P. Jaagosild, F.M. Fouad-Tarazi. *Syncope Clinic, Cleveland Clinic Foundation, Cleveland, OH, USA*

Background: Patients with syncope have a variety of hemodynamic disturbances. History of syncope in patients with awake supine bradycardia (SB) is usually attributed to electrophysiological mechanisms involving sinus node dysfunction and inability to increase heart rate (HR). We examined: 1) if the HR changes in response to tilt table testing in adults with SB and 2) if the HR response correlates with the hemodynamic state of these patients.

Methods: Of the 387 patients who underwent tilt table testing for work up of syncope or presyncope from 8/96 to 7/97, 93 patients were found to have SB (average HR <60 after 45 minutes of rest). All underwent tilt table testing (30° and 45° for two minutes each, then 60° to 70° of tilt for maximum of 45 minutes). Of these, 85 patients had blood volume assessed by RISA and 54 had systemic hemodynamics measured by first pass 99m Technetium.

Results: The mean ± SD age was 47.3 ± 19.7 and 53% were female. The mean ± SD increase in HR in response to tilt was 29 ± 18 beats per minute. A correlation was observed between the tilt induced increase in HR and supine hemodynamic parameters: total blood volume (R = 0.29, p = 0.035), pulmonary circulation time (R = −0.38, p = 0.005), peripheral resistance (R = −0.50, p = 0.0001), and supine cardiac index (R = −0.43, p = 0.001).

Conclusions: A large proportion of patients with SB and history of syncope are able to increase HR during tilt and therefore do not have chronotropic insufficiency. There is a large variation in the degree of HR increase in response to tilt. The tilt induced HR response in patients with SB correlates with total blood volume, pulmonary circulation time, peripheral resistance, and supine cardiac index. Correction of these underlying hemodynamic abnormalities may lead to prevention of syncopal spells in these patients.

4:45

868-4 Vasovagal Syncope: Differences Between Passive Tilt and Isoproterenol Tilt Table Testing

W.K. Shen, D. Beinborn, A. Jahangir, C. Lohse, D.O. Hodge, S.C. Hammill. *Mayo Clinic, Rochester, MN, USA*

Background: We and other investigators have reported that single-stage isoproterenol tilt table testing (Iso-TT) was effective in the provocation of vasovagal (VV) syncope and significantly reduced procedural time when compared to the passive tilt table testing (P-TT). Concerns have been raised regarding the physiologic differences between these tests.

Methods: In this prospective study, hemodynamics were assessed in 87 consecutive patients (mean age 56 + 19 yrs, F/M = 43/44) with a history of syncope. The study protocol consisted of P-TT (10 mins supine → 45 mins tilt at 70°) and Iso-TT (0.05 mcg/kg/min, 10 mins supine → 10 mins tilt at 70°). Each pt underwent both tests sequentially in a randomized fashion.

Results: Of the total, 23 pts (mean age 55 ± 22 yrs F/M = 17/6) had a VV response during P-TT and Iso-TT. Results are shown in table.

In supine position, HR is significantly higher, DBP is significantly lower during Iso-TT when compared to P-TT reflecting Iso-mediated β-receptor activation. During VV syncope, HR, SBP, and DBP remained higher during Iso-TT than P-TT.

Parameters	Test	Supine	P	Syncope	P
HR	P-TT	73 ± 14		58 ± 21	
(bpm)	Iso-TT	102 ± 20	0.0001	84 ± 28	0.004
SBP	P-TT	141 ± 23		60 ± 13	
(mmHg)	Iso-TT	136 ± 25	0.4	68 ± 12	0.03
DBP	P-TT	70 ± 13		29 ± 14	
(mmHg)	Iso-TT	62 ± 15	0.03	35 ± 14	0.03

Conclusions: Hemodynamic responses prior to and during a VV syncope are significantly different between P-TT and Iso-TT. Results obtained in the laboratory should be interpreted with caution and correlated to pts clinical presentation.

5:00

868-5 Complex Demodulation of Cardiorespiratory Dynamics Preceding Vasovagal (VV) Syncope

L. Lipsitz, J. Hayano, S. Sakata, A. Okada, R. Morin. *Hebrew Rehabilitation Center for Aged, Boston, MA, USA; Nagoya City University, Nagoya, Japan*

Background: Cardiorespiratory dynamics leading to VV syncope are poorly understood.

Methods: We used complex demodulation to continuously assess changes in respiration, RR interval, and arterial pressure (BP) variability during 60° head-up tilt, in 25 healthy subjects with tilt-induced VV syncope and 25 age-matched non-syncopal controls. Coherence and transfer function analyses examined the relationship between respiration and RR interval variability prior to syncope.

Results: Baseline BP, RR, and ventilation were similar between syncope subjects and controls. Syncope subjects experienced hyperventilation and hypotension beginning 3 min. before the development of symptoms. This was unaccompanied by changes in RR interval or RR variability until 90 sec. before syncope when RR interval and its variability suddenly increased. Relatively few subjects had coherence between respiratory and RR interval variabilities, and syncope subjects had lower transfer magnitudes compared to controls. Non-syncopal subjects had no change in respiratory, RR interval, or BP dynamics during matched time periods prior to the time of syncope.

Conclusions: VV syncope is preceded by a period of hyperventilation and cardiorespiratory decoupling, followed by an abrupt increase in cardiovagal tone. Respiratory pumping without inspiratory cardiac slowing may partially counteract preload reduction until sudden bradycardia precipitates syncope.

5:15

868-6 Elevated Parasympathetic Nerve Tone in Isoproterenol-Induced Vasovagal Syncope During Head-up Tilt Test

A. Takei, Y. Ohnishi, T. Shima, K. Yamashiro, K. Adachi, M. Yokoyama. *First Department of Internal Medicine, Kobe University School of Medicine, Kobe, Japan*

Isoproterenol (ISP) is considered to be useful in evoking a vasovagal reaction during head-up tilt test (HUT). However, the autonomic nerve mechanism whereby ISP induces this reaction is unknown. Twenty-seven patients (pts) with recurrent syncopal episodes underwent HUT (80 degrees for 15 min.). Syncope was induced by initial HUT in 9 pts (Ini/+). The remaining 18 pts (Ini/−) underwent the following HUT with ISP infusion. Syncope was induced in 11 pts (ISP/+) and not in 7 pts (ISP/−). We assessed the indices of autonomic nerve tone (HF, LF/HF) detected by spectral analysis of heart rate variability for 2 min. at baseline (T1), during the first 2 min. (T2) and the last 2 min. (T3) of tilting in each HUT. The percent changes in HF and LF/HF (%ΔHF, %ΔL/H) between T1 (T2) and T2 (T3) were calculated.

Results: HF (T3) in Ini/+ was greater than that in Ini/− ($p < 0.05$). HF (T2) and HF (T3) in ISP/+ were greater than those in ISP/− ($p < 0.05$). %ΔHF (T1T2) in ISP/+ was greater than those in the others ($p < 0.05$), while %ΔHF (T2T3) in Ini/+ was greater than those in the others ($p < 0.05$). No difference was observed in %ΔL/H among groups.

Conclusion: Early and persistent increase of parasympathetic nerve tone activated by ISP plays an important role for the enhancement of the vasovagal reaction during HUT.

	HF (T1)	HF (T2)	HF (T3)	%HF (T1T2)	%HF (T2T3)
Ini/+	2.3 ± 0.5	1.1 ± 0.6	1.5 ± 1.0**	−53 ± 19	44 ± 65†
Ini/−	2.1 ± 1.3	0.9 ± 0.5	0.9 ± 0.4	−38 ± 44	0 ± 29
ISP/+	1.0 ± 1.0	1.4 ± 0.9*	1.3 ± 1.1*	116 ± 132†	−9 ± 44
ISP/−	1.1 ± 0.7	0.7 ± 0.6	0.4 ± 0.2	−22 ± 43	−20 ± 38

(*: $p < 0.05$ vs ISP/−, **: $p < 0.05$ vs Ini/−, †: $p < 0.05$ vs the others)